3.7 Thorn Creek

The Thorn Creek subwatershed encompasses approximately 32 square miles (22.86 in Cook County and 8.92 in Will County) within the Little Calumet River watershed. There are eight tributaries including Thorn Creek, totaling over 26 stream miles. **Table 3.7.1** lists the communities and the drainage areas contained within the Thorn Creek subwatershed.

Table 3.7.1: Communities Draining to Thorn Creek Subwatershed Within Cook County

Community	Tributary Area (mi^2)
Calumet City	<0.01
Chicago Heights	7.03
East Hazel Crest	0.05
Flossmoor	0.07
Glenwood	0.96
Homewood	0.17
Lansing	0.26
Matteson	0.28
Olympia Fields	0.07
Park Forest	3.40
Richton Park	0.35
South Chicago Heights	1.31
South Holland	0.99
Steger	0.61
Thornton	2.10
Unincorporated Cook County	5.22
University Park	<0.01

Table 3.7.2 lists the land use breakdown by area within the Thorn Creek subwatershed. **Figure 3.7.1** provides an overview of the tributary area of the subwatershed. Reported stormwater problem areas and proposed alternative projects are also shown on the figure, and are discussed in the following subsections.

Within the Thorn Creek subwatershed, a total of 26.6 stream miles were studied among the eight tributaries.

- Thorn Creek (THCR) – extends from near Steger Road and Western Avenue at the boundary between Cook and Will counties in Park Forest to the confluence with the Little Calumet River 0.5 miles north of 170th Street in South Holland.

Table 3.7.2: Land Use Distribution for Thorn Creek Subwatershed Within Cook County

Land Use	Acres	%
Commercial/Industrial	2,995	20
Forest/Open Land	4,848	33
Institutional	772	5
Residential	5,038	34
Transportation/Utility	467	3
Water/Wetland	179	1

- Thorn Creek Tributary A (TCTA) – extends from the intersection of 33rd Street between Lewis Avenue and Loverock Avenue in Steger to the confluence with Thorn Creek, near the intersection of Joe Orr Road and the Union Pacific Railroad, about 2,000 feet west of State Street in Chicago Heights.

- Thorn Creek Tributary A of A (TCAA) – extends from Sauk Trail Road east of Western Avenue in South Chicago Heights and flows northerly to 26th Street in Chicago Heights.

- Thorn Creek Tributary B (TCTB) – extends from north of the US Route 30 (Lincoln Highway) and Wilson Avenue intersection in Chicago Heights to the confluence with Thorn Creek east of Edgewood Avenue and 13th Street.

- Thorn Creek Tributary A of B (TCAB) – extends from 10th Street and Damico Drive in Chicago Heights, through the Chicago Heights Country Club, to the confluence with Thorn Creek Tributary B near the intersection of Irving Boulevard and Franklin Avenue.

- Thorn Creek Tributary C (TCTC) – extends from Coolidge Street and Glengate Avenue in Chicago Heights to the confluence with Thorn Creek near the Chicago Heights Park District Golf Course.

- Thorn Creek Tributary D (TCTD) – extends from the Rich East High School Pond in Park Forest near East Rocket Circle Drive and West Rocket Circle Drive, to the confluence with Thorn Creek near Beacon Boulevard and Campbell Avenue in Chicago Heights.

- Thorn Creek Tributary E (TCTE) – extends from 34th Street (Steger Road), 700 feet east of Western Avenue, to the confluence with Thorn Creek.

The Thorn Creek subwatershed contains two major detention facilities, the Thornton Transitional Reservoir and Sauk Trail Lake.

- Thornton Transitional Reservoir – The Thornton Transitional Reservoir is located in the West Lobe of Thornton Quarry, southeast of I-294/I-80 and Halsted (US 1). The reservoir has capacity for 9,600 acre-feet from non-Tunnel and Reservoir Plan (TARP) flows. The transitional reservoir came online in 2003. Floodwaters from Thorn Creek flow through a diversion inlet structure, drop 230 feet down a 24-foot diameter shaft, and flow through an 8,000-foot long, 22-foot diameter tunnel into the reservoir. After the storm passes, the reservoir is drained through an 8-foot diameter tunnel for pumping to the Calumet Water Reclamation Plant for treatment and eventual discharge to the Little Calumet River.

- Sauk Trail Lake – Sauk Trail Lake Dam, also known as Sauk Trail Lake, is of earthen construction. Sauk Trail Lake is on Thorn Creek in Cook County and is used for recreation purposes. Its capacity is 376 acre-feet (height is 18 feet, length is 355 feet), with normal storage of 122 acre-feet. Construction was completed in 1923. It is owned by the Forest Preserve District of Cook County.

3.7.1 Sources of Data

3.7.1.1 Previous Studies

Studies have been performed for the Thorn Creek subwatershed for assessing stormwater flooding problems and evaluating structural solutions. Below is the list of studies that were identified for Thorn Creek:

- *Interim Review Report of Little Calumet River*, U.S. Army Corps of Engineers, December 1973

- *Little Calumet River Watershed Engineering Design Report (Revised)*, U.S. Department of Agriculture, Metropolitan Sanitary District of Greater Chicago and the Illinois Department of Conservation, January 1977

During Phase A and B of DWP development, additional survey, topography, precipitation, stream flow, land use and soils data needed for the development of the Thorn Creek subwatershed model were identified and collected.

3.7.1.2 Water Quality Data

Water quality for the Thorn Creek subwatershed is monitored by the Metropolitan Reclamation District of Greater Chicago (the District), Illinois Environmental Protection Agency (IEPA) and the United States Geological Survey (USGS). The District is responsible for monitoring the water quality of streams and canals within its jurisdiction, and has one water quality monitoring station, Station 54, located on Thorn Creek at Joe Orr Road. Detailed annual water quality summaries of all the water quality data collected have been published by the District for the years 1970 through 2007, except for the year 1971.

IEPA monitors water quality at six locations in the Thorn Creek subwatershed as a part of the Ambient Water Quality Monitoring Network (AWQMN) in Cook County. **Table 3.7.3** lists the locations of the six gages.

Table 3.7.3: IEPA Water Quality Monitoring Stations in the Thorn Creek Subwatershed

Station ID	Waterbody	Location
HBDD-01	Thorn Creek Tributary B	Joe Orr Road, Chicago Heights
HBDD-02	Thorn Creek Tributary B	0.5 MI NE Chicago Heights
HBD-01	Thorn Creek	167th Street NE, S Holland
HBD-02	Thorn Creek	Vincennes Avenue, Glenwood
HBD-03	Thorn Creek	Dixie Highway, Chicago Heights
HBD-04	Thorn Creek	Dixie Highway, Chicago Heights

Source: EPA STORET (Storage and Retrieval) database.

At each station, water samples are collected once every six weeks and analyzed for a minimum of 55 water quality parameters including pH, temperature, specific conductance, dissolved oxygen, suspended solids, nutrients, fecal coliform bacteria, and total and dissolved metals. Additional parameters specific to the station, watershed, or sub network within the ambient network are also analyzed.

The USGS operates three water quality monitoring stations in the Thorn Creek subwatershed. Several of the USGS stations identified for flow and stage recordings also have water quality measurements. Sporadic data recordings are taken at each of the sites, though they are typically recorded at least once a month. The period of

record and type of data monitored vary from station to station. **Table 3.7.4** lists additional details for the gages.

Table 3.7.4: USGS Water Quality Monitoring Stations in the Thorn Creek Subwatershed

Station ID	Waterbody	Location
5536210	Thorn Creek	Chicago Heights
5536215	Thorn Creek	Glenwood
5536275	Thorn Creek	Thornton

Source: http://waterdata.usgs.gov/usa/nwis/qw

IEPA's *2008 Integrated Water Quality Report,* which includes the Clean Water Act (CWA) 303(d) and the 305(d) lists six segments within the Thorn Creek subwatershed as impaired. **Table 3.7.5** lists the 303(d) listed impaired waters.

Table 3.7.5: IEPA Use Support Categorization and 303(d) Impairments in the Thorn Creek Subwatershed

IEPA Segment ID	Waterbody	Impaired Designated Use	Potential Cause	Potential Source
IL_HBD-03	Thorn Creek	Aquatic Life	Dissolved Oxygen	Dam or Impoundment, Impacts from Hydrostructure Flow Regulation/Modification
IL_ HBD-05	Thorn Creek	Aquatic Life	Total Dissolved Solids	Urban Runoff/Storm Sewers
IL_HBD-06	Thorn Creek	Aquatic Life	Aldrin, Dieldrin, Hexachlorobenzene, Nitrogen (Total), Dissolved Oxygen, Phosphorous (Total) and Silver	Contaminated Sediments, Municipal Point Source Discharges and Urban Runoff/ Storm Sewers
		Primary Contact Recreation	Fecal Coliform	Municipal Point Source Discharges, Urban Runoff/ Storm Sewers
IL_HBD-04	Thorn Creek	Aquatic Life	Aldrin, Chlordane, DDT, Endrin, Fluoride, Polychlorinated biphenyls Dieldrin, Total Suspended Solids, Zinc, Hexachlorobenzene, Nitrogen (Total), Dissolved Oxygen, Phosphorous (Total) and Silver	Contaminated Sediments, Municipal Point Source Discharges and Urban Runoff/ Storm Sewers and Channelization
		Primary Contact Recreation	Fecal Coliform	Source Unknown

Table 3.7.5: IEPA Use Support Categorization and 303(d) Impairments in the Thorn Creek Subwatershed

IEPA Segment ID	Waterbody	Impaired Designated Use	Potential Cause	Potential Source
IL_HBD-02	Thorn Creek	Aquatic Life	Aldrin, Chlordane, DDT, Endrin, Fluoride, Polychlorinated biphenyls, Dieldrin, Total Suspended Solids, Zinc, Hexachlorobenzene, Nitrogen (Total), Dissolved Oxygen, Phosphorous (Total) and Silver	Contaminated Sediments, Municipal Point Source Discharges and Urban Runoff/ Storm Sewers
		Primary Contact Recreation	Fecal Coliform	Urban Runoff/Storm Sewers
IL_RH1	Sauk Trail (Thorn Creek)	Aesthetic Quality	Phosphorus (Total) & Total Suspended Solids	Urban Runoff/Storm Sewers, Site Clearance (Land Development and Redevelopment), Impacts from Hydrostructure Flow Regulation/modification, Crop Production (Crop Land or Dry Land), Runoff from Forest/Grassland/Parkland
		Aquatic Life	Dissolved Oxygen, Phosphorous (Total), Polychlorinated biphenyls, Sedimentation/Siltation and Total Suspended Solids	Runoff from Forest/Grassland/ Parkland, Urban Runoff/Storm Sewers, Site Clearance (Land Development or Redevelopment), Impacts from Hydrostructure Flow Regulation/modification, Crop Production (Crop Land or Dry Land)

Total Maximum Daily Loads (TMDL) have been developed for the Thorn Creek subwatershed. **Table 3.7.6** lists the water segments in the Thorn Creek subwatershed and the impairment addressed.

Table 3.7.6: IEPA TMDL Status in the Thorn Creek Subwatershed

Station ID	Waterbody	Impairment Addressed	TMDL Status
IL_HBD-02	Thorn Creek	Dissolved Oxygen, Fecal Coliform, Fluoride, Silver and Zinc	Stage 1
IL_HBD-03	Thorn Creek	Dissolved Oxygen	Stage 1
IL_HBD-04	Thorn Creek	Thornton Dissolved Oxygen, Fecal Coliform, Fluoride, Silver and Zinc	Stage 1
IL_HBD-06	Thorn Creek	Dissolved Oxygen, Fecal Coliform and Silver	Stage 1
IL_RHI	Sauk Trail (Thorn Creek)	Dissolved Oxygen	Stage 1

Source: http://www.epa.state.il.us/water/tmdl/303-appendix/2008/appendix-a6-status.pdf

NPDES point source discharges within the Thorn Creek subwatershed are listed in **Table 3.7.7.** In addition to the point source discharges listed, municipalities discharging to Thorn Creek or its tributaries are regulated by IEPA's NPDES Phase II Stormwater Permit Program, which was created to improve the quality of stormwater

runoff from urban areas, and requires that municipalities obtain permits for discharging stormwater and implement six minimum control measures for limiting runoff pollution to receiving systems. Also as part of the Phase II Stormwater Permit Program, construction sites disturbing greater than 1 acre of land are required to get a construction permit.

Table 3.7.7: Point Source Dischargers in Thorn Creek Area

Name	NPDES	Community	Receiving Waterway
Park Forest Excess Flow Facility	IL0047562	Park Forest	Unnamed Ditch to Thorn Creek
Hanson Material Service Yd 41	IL0001937	Thornton	Thorn Creek

Note: NPDES facilities were identified from the USEPA Water Discharge Permits Query Form at http://www.epa.gov/enviro/html/pcs/pcs_query_java.html.

3.7.1.3 Wetland and Riparian Areas

Figures 2.3.6 and **2.3.7** contain mapping of wetland and riparian areas in the Little Calumet River Watershed. Wetland areas were identified using National Wetlands Inventory (NWI) mapping. NWI data includes roughly 784 acres of wetland areas in the Thorn Creek subwatershed. Riparian areas are defined as vegetated areas between aquatic and upland ecosystems adjacent to a waterway or body of water that provides flood management, habitat, and water quality enhancement. Identified riparian environments offer potential opportunities for restoration.

3.7.1.4 Floodplain Mapping

All the tributary names used in this study were adopted from FEMA's Cook County Flood Insurance Study, August 2008, except for Thorn Creek Tributary A of A, Thorn Creek Tributary D and Thorn Creek Tributary E. Tributary A of A was shown in the FEMA mapping but was not officially named; therefore it was named for the DWP. FEMA had classified Thorn Creek Tributary D as Zone X, meaning the 1% interval flood had an average depth of less than 1 foot or the drainage area was less than 1 square mile. However, the DWP determined that flooded areas had significant depths and the drainage area was in excess 1 square mile; therefore, Thorn Creek Tributary D was added to the study. Thorn Creek Tributary E was modeled by FEMA as a backwater, but was included in the DWP since it has a drainage area over 1 square mile and has a defined channel.

FEMA's 2006 effective models were not made available during the development of the Thorn Creek subwatershed hydraulic model; however, various models were collected from MG2A/Land Resources Management Group, IDNR-OWR, and USACOE.

Appendix A includes a comparison of FEMA's effective floodplain mapping from updated DFIRM panels (effective date August 2008) with inundation areas developed for the DWP.

3.7.1.5 Stormwater Problem Data

Table 3.7.8 summarizes reported problem areas reviewed as a part of DWP development. The problem area data was obtained primarily from questionnaire

response data (Form B) provided by watershed communities to the District. Problems are classified in **Table 3.7.8** as regional or local. This classification is based on a process described in **Section 2.2.1** of this report.

3.7.1.6 Near Term Planned Projects

No near-term planned major flood control projects have been identified for the Thorn Creek subwatershed.

Table 3.7.8: Community Response Data for Thorn Creek Subwatershed

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
BL03	Bloom Township	72" CMP at Stewart Avenue, at Third Creek. Significant vegetation present. Slight drifting of creek	26th Street from East End Avenue to State Street	Culvert and channel blockage	Local	Contact Small Streams Maintenance Program
BL05	Bloom Township	Structure number 016-3224, a 2-10' by 6' box culvert north of 22nd Street, at Third Creek. Box culvert is silted and migrating north	State Street from Sauk Trail to Main Street	Problem may be due to overland flooding	Local	Local drainage problem since problem likely due to overland flow
CHT2	Chicago Heights	Small ditch floods from the culvert below the railroad tracks, likely caused by a blockage, 3 homes with basement flooding. Includes commercial properties	26th Street, Chicago Road	Problem is due to local drainage issues	Local	Problem is not on a regional waterway. This is a local problem
CHT7	Chicago Heights	Overbank flooding	Halsted and Main Street	Problem is due to local drainage issues	Local	Problem is not on a regional waterway
CHT5	Chicago Heights	Roadway pavement flooding	Route 30 at Halsted Street	Problem is due to local drainage issues	Local	Problem is not on a regional waterway
CHT6	Chicago Heights	Roadway pavement flooding	US Route 30 at State and East End Avenue	Problem is due to local drainage issues	Local	Problem is not on a regional waterway
CHT8	Chicago Heights	Ponding, water quality and bank erosion and sedimentation	12th Street and Halsted	Problem is due to local drainage issues	Local	Problem is not on a regional waterway
CHT1	Chicago Heights	Overbank flooding, basement flooding	Miller Avenue (Chicago, Route 1) to Jackson -- Railroad tracks	Problem is due to local drainage issues	Local	Problem is not on a regional waterway

Table 3.7.8: Community Response Data for Thorn Creek Subwatershed

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
GLW2	Glenwood	Overbanking of Thorn Creek and Butterfield Creek due to high rain volumes, stream obstruction, and non-operation of MWRD diversion chamber	187th Street and Glenwood-Chicago Heights Road	Low lying residential area and Boy's school is inundated from overbank flooding from Thorn and Butterfield Creek	Regional	Conveyance Improvement, Levees, Flow Diversion and Storage (Alternative THCRG1-A16)
LAN7	Lansing	Tri-state Expressway flooding, beaver dams and erosion	Lake Wampum Forest Preserve	Erosion along the banks of Forest Preserve lake. Appeared that problem had been resolved, during field inspection	Local	Problem previously resolved
OLY6	Olympia Fields	The Inlet capacity within the intersection does not appear to have adequate capacity to accept the runoff during moderate to heavy rainfall events and the intersection tends to pond water	Western Avenue and US Route 30 (Lincoln Highway)	Problem is due to local drainage issues	Local	Problem is not on a regional waterway. This is a local storm sewer issue
OLY11	Olympia Fields	Pavement flooding	US Route 30 at Western Avenue	Problem is due to local drainage issues. Appears to the same problem as OLY6	Local	Problem is not on a regional waterway. This is a local storm sewer issue
PAR1	Park Forest	During large rain events, drainageway becomes flooded and ponds. Water levels rise into backyards of the residents that reside adjacent to this drainageway	East Rocket Circle/West Rocket Circle (near Lakewood Boulevard/ Orchard Drive)	Residential ponding from Thorn Creek Tributary D due to under-sized culverts	Regional	Create offline storage facility, upstream conveyance Improvements (Alternative TCTDG1-A9)

Table 3.7.8: Community Response Data for Thorn Creek Subwatershed

Problem ID	Municipality	Problems as Reported by Local Agency	Location	Problem Description	Local/ Regional	Resolution in DWP
PAR2	Park Forest	Stormwater flow restriction at twin culvert pipes crossing under Western Avenue Pipes are restricted by tree branches, vegetation, sediment, and debris to approximately 90-95% of pipe cross-sectional area	Western Avenue/EJ&E Railroad (South Street)	Local drainage obstructions	Local	Local maintenance issue
PAR3	Park Forest	Pavement flooding	26th Street at Euclid Avenue to Western Avenue	Major road/dam outlet is overtopping	Regional	Conveyance improvement, levees, flow diversion and storage (Alternative THCRG1-A16)
PAR4	Park Forest	Pavement flooding	Western Avenue at Route 30 to 26th Parkway	Problem is due to local drainage issues	Local	Local drainage issue not on regional waterway
RIC5	Richton Park	Flooding occurs at two locations along this tributary. The flooding takes place primarily with rain events of 1" or more	Tributary crossing with Central Park Avenue, north	Undersized culverts in ditch in an area of less than 1 square mile	Local	Problem area not located on regional waterway
SHO3	South Holland	Pavement flooding	I-94 at 170th Street	Overtopping of major roadway	Regional	Problem previously resolved; no action required
SHO2	South Holland	Pavement flooding	I-94 at 159th Street (to I-80)	Flooding of highway. Residents stated that problem no longer exists since Thornton Transitional Quarry came online. No flooding shown in model	Regional	Problem previously resolved; no action required
TRN1	Thornton	Flooding of ground and lower levels of commercial building	400 East Margaret Street (Brownell)	Overbank flooding from Thorn Creek in Tributary in low-lying area on river bank	Regional	Risk of flooding could not be mitigated by structural measures. Property is a candidate for protection using non-structural measures such as floodproofing or acquisition

3.7.2 Watershed Analysis

3.7.2.1 Hydrologic Model Development

Subbasin Delineation. The Thorn Creek subwatershed was delineated based upon LiDAR topographic data developed by Cook County in 2003. There are 48 subbasins ranging in size from 0.018 to 4.22 square miles with an average size of 0.644 square miles.

Hydrologic Parameter Calculations. Curve numbers (CN) were estimated for each subbasin based upon NRCS soil data and 2001 CMAP land use data. This method is further described in **Section 1.3.2**, with lookup values for specific combinations of land use and soil data presented in Appendix C. An area-weighted average of the CN was generated for each subbasin.

Clark's unit hydrograph parameters were estimated using the method described in **Section 1.3.2**. Appendix G provides a summary of the hydrologic parameters used for subbasins in each subwatershed.

3.7.2.2 Hydraulic Model Development

Field Data, Investigation, and Existing Model Data. The FEMA effective hydraulic models were not available for use in developing the hydraulic model for the Thorn Creek subwatershed. Three models from other sources were made available. The MG2A/Land Resources Management Group model for Thorn Creek Tributary A (2007), IDNR-OWR model for Thorn Creek Tributary B (2000) and USACOE model for Thorn Creek Main Stem (2007) were used in the development of the hydraulic model for Thorn Creek and its tributaries. The models were reviewed to determine if any of the cross-sectional data and hydraulic structure information could be reused. If any information regarding location, date, and vertical datum was not available, the cross-sectional data was not used. Cross sections were compared to the current channel conditions to ensure that they were still representative of current conditions. The hydraulic structure dimensions were compared to 2007 field reconnaissance data and also to bridge/culvert dimensions data provided by Cook County Highway Department (data provided only state/county highways). Based on the existing model analysis additional cross sections and hydraulic structures to be surveyed were determined. Any data used from the existing models were geo-referenced to represent true physical coordinates.

After review of existing models, field reconnaissance data and hydraulic structures dimensions data, a field survey plan for Thorn Creek was developed. Field survey was performed under the protocol of FEMA's *Guidelines and Specifications for Flood Hazard Mapping partners, Appendix A: Guidance for Aerial Mapping and Surveying.* Field survey was performed in early 2008. Cross sections were generally surveyed between 500 to 1,000 feet apart. The actual spacing and location was determined based on the variability of the channel's shape, roughness, and slope. A total of 66 cross sections and 57 hydraulic structures were surveyed to develop the hydraulic model for Thorn

Creek. Additional cross sections were developed by interpolating the surveyed channel data and combining with contour data.

The Manning's n-value at each cross section was estimated using a combination of aerial photography and photographs from field survey and field reconnaissance. The horizontal extent of each type of land cover and the associated n-value for each cross section were manually entered in to the HEC-RAS hydraulic model. The initial n-values were used as a model starting point and were adjusted within the provided ranges during calibration. All the n-values were manually adjusted using the HEC-RAS cross-sectional data editor.

The n-values were increased where buildings are located within the floodplain to account for conveyance loss. The n-values in these areas may range from 0.060 for areas with few buildings to 0.20 for fully developed areas. If significant blockage is caused by buildings in the flood fringe, the developed areas were modeled as ineffective flow. **Table 3.7.9** lists the channel and overbank ranges of n-values that were used for the Thorn Creek subwatershed model.

Table 3.7.9: Channel and Overbank Associated Manning's n-Values[1]

Tributary	Range of Channel n-Values	Range of Overbank n-Values
THCR	0.037-0.08	0.057-0.21
TCTA	0.013-0.075	0.037-0.15
TCAA	0.062	0.062
TCTB	0.037-0.062	0.037-0.162
TCAB	0.013-0.056	0.037-0.10
TCTC	0.013-0.068	0.013-0.10
TCTD	0.03-.125	.037-0.15
TCTE	0.56-0.62	0.15

[1]**Source**: Open Channel Hydraulics, Chow 1959

Boundary Conditions. There is a single location where a stage boundary condition was required to run the Thorn Creek hydraulic model, located at the confluence of Thorn Creek with the Little Calumet River. Normal depth was used.

3.7.2.3 Calibration and Verification

A detailed calibration was performed for the Thorn Creek subwatershed using historic gage records under the guidelines of the Cook County Stormwater Management Plan (CCSMP). Three historical storms, April 2006, April 2007, and September 2008, were evaluated based on the stream gage flows, precipitation amounts and records of flooding in the Thorn Creek subwatershed and were found to be applicable for calibration and verification.

For the calibration storms, Illinois State Water Survey (ISWS) Cook County precipitation gages, National Weather Service (NWS) recording and non-recording gages, and Community Collaborative Rain, Hail & Snow Network (CoCoRAHS) precipitation amounts were used. Theissen polygons were developed for each storm

based on the rain gages available for that storm. The gage weightings for the recording and non-recording gages were computed in ArcGIS for each subbasin.

There are two active stream gages in the Thorn Creek subwatershed. Gage 05536275 on Thorn Creek at Thornton is at latitude 41°34'06", longitude 87°36'28" (NAD27). The datum of the gage is 586.43 feet NGVD29 (586.15 NAVD88). Instantaneous flow data is available at this gage from 09/01/1986 through 9/30/2007. USGS Gage 05536215 on Thorn Creek at Glenwood is located at latitude 41°31'49", longitude 87°37'20" (NAD27), on the right bank 20 feet downstream from the Cook County Forest Preserve bike trail, 1 mile upstream of Deer Creek. The datum of the gage is 610.97 feet NGVD29 (610.66 NAVD88). Instantaneous flow data is available at this gage from 10/01/1993 through 9/30/2005.

Runoff hydrographs were developed using HEC-HMS and routed through the Thorn Creek hydraulic model. The stages and flows produced for each calibration storm were compared to the observed stream gage data. During calibration of the Thorn Creek subwatershed model, the curve number, directly connected impervious area percentage, and lag times were adjusted so that the peak flow rate, hydrograph shape and timing, and total volume matched the observed hydrographs within the District's criteria.

During calibration, the curve number and directly connected impervious percentage were reduced by 5% and 10%, respectively. The Clark's storage coefficient R was increased by 25%.

After the final adjustments to the HEC-HMS and HEC-RAS models, the flow and stage comparisons to the observed data were within the CCSMP's criteria. **Table 3.7.10** and **Table 3.7.11** show the comparison of the flows and stages for all calibration storms. **Figures 3.7.2**, **3.7.3**, **3.7.4** and **3.7.5** show the calibration results for the April 2006, April 2007 and September 2008 storm events.

Table 3.7.10: Thorn Creek Subwatershed Calibration Results, Thorn Creek at Thornton

Storm Event	Observed		Modeled		CCSMP's Criteria[1]	
	Flow (cfs)	Stage	Flow (cfs)	Stage	Percentage Difference in Peak Flow	Difference in Stage (ft)
Apr-06	5540	600.19	5056	600.16	-9%	-0.03
Apr-07	1810	596.57	1773	597.04	-2%	0.47
Sep-08	5860	601.76	7398	602.04	26%	0.28

[1]Flow within 30% and stage within 6 inches.

Table 3.7.11: Thorn Creek Subwatershed Calibration Results, Thorn Creek at Glenwood

Storm Event	Observed		Modeled		CCSMP's Criteria[1]	
	Flow (cfs)	Stage	Flow (cfs)	Stage	Percentage Difference in Peak Flow	Difference in Stage (ft)
Apr-06	2540	621.94	2774	623.07	9%	1.13
Apr-07	926	619.99	848	620.18	-8%	0.19
Sep-08[2]	N/A	N/A	3330	623.48	N/A	N/A

[1]Flow within 30% and stage within 6 inches.
[2]Flow and stage data for September 2008 event not available at Glenwood gage.

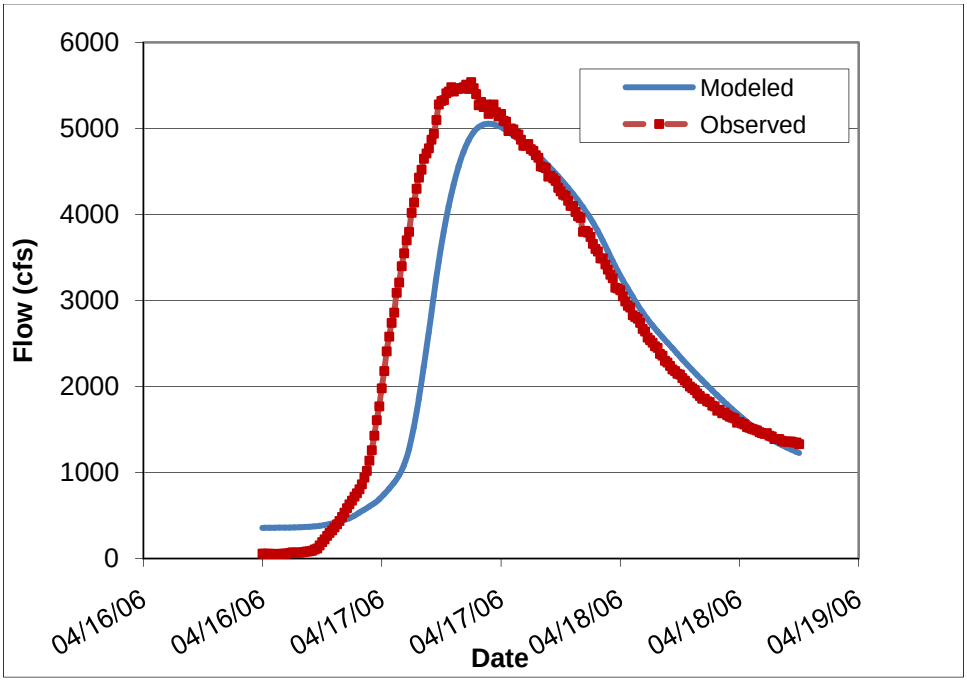

Figure 3.7.2: Thorn Creek at Thornton Calibration Results, April 2006 Storm Event

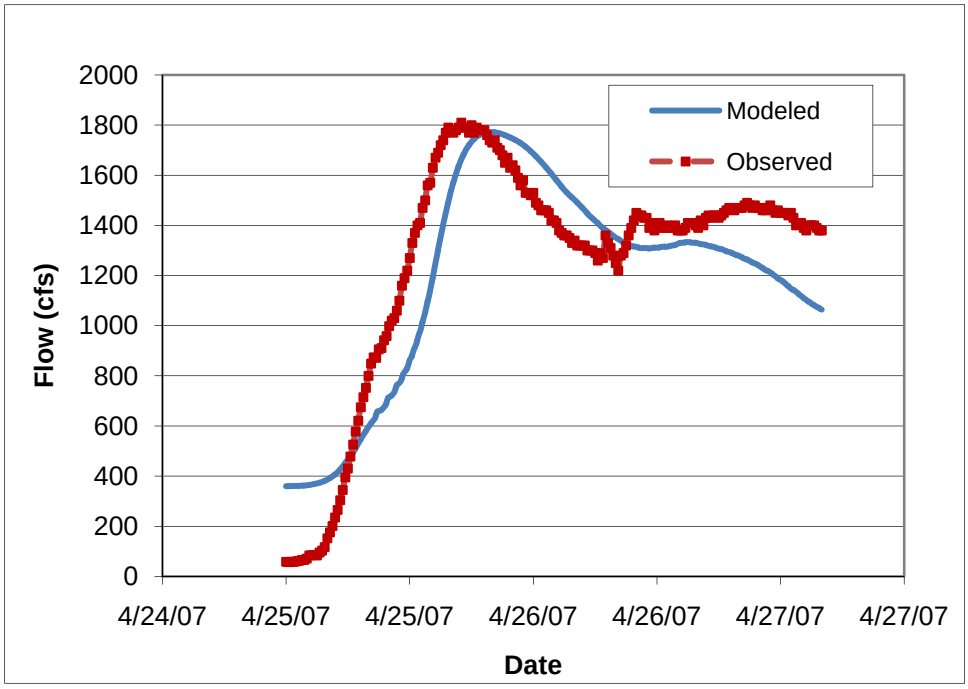

Figure 3.7.3: Thorn Creek at Thornton Calibration Results, April 2007 Storm Event

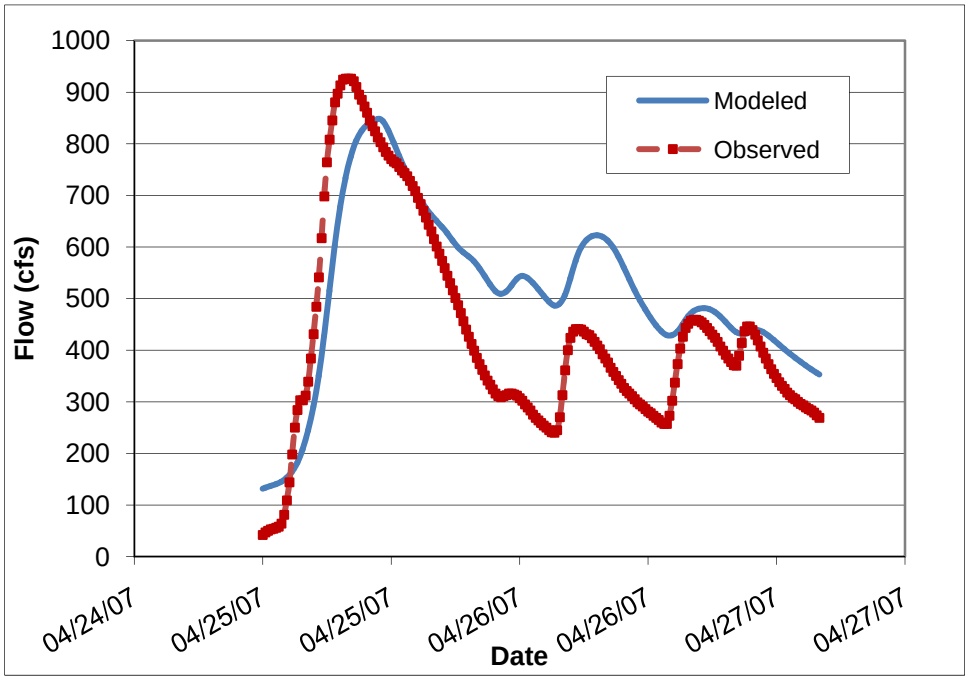

Figure 3.7.4: Thorn Creek at Glenwood Calibration Results, April 2007 Storm Event

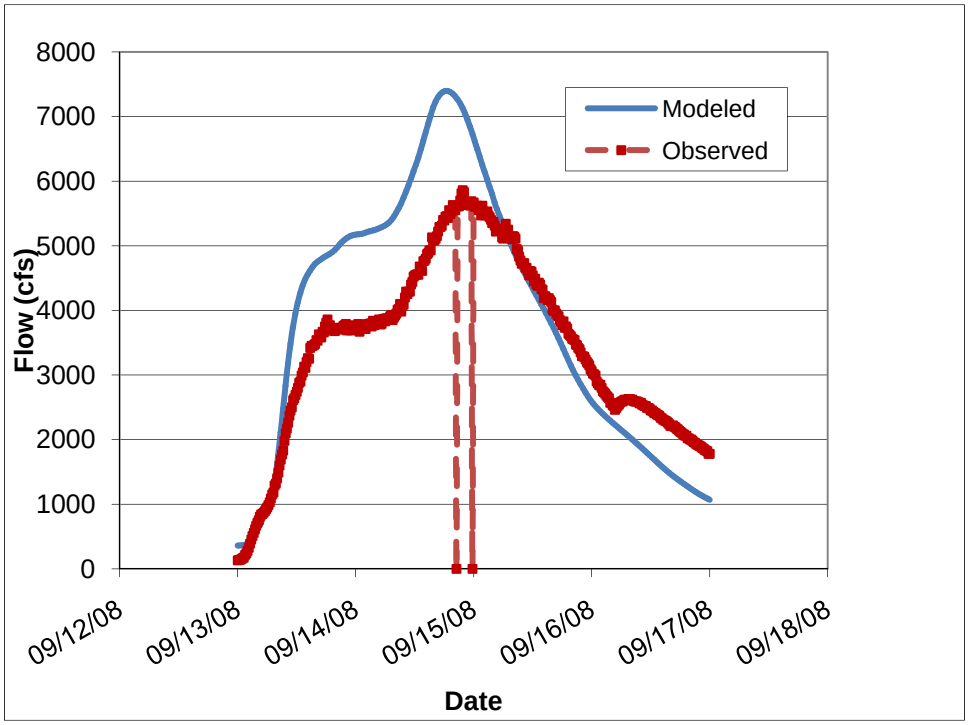

Figure 3.7.5: Thorn Creek at Thornton Calibration Results, September 2008 Storm Event

3.7.2.4 Existing Conditions Evaluation

Flood Inundation Areas. A critical duration analysis was performed for the Thorn Creek subwatershed hydraulic model. The 100-year, 1-, 3-, 6-, 12-, 24- and 48-hour storm events were run to determine the critical duration. The 6-hour storm event was found to be the critical duration event for Thorn Creek Tributary A of B, and a portion of Thorn Creek Tributary B and Thorn Creek Tributary D. The 48-hour storm event was found to be the representative critical duration for the remainder of the reaches.

Figure 3.5.1 shows inundation area produced for the 100-year critical duration storm event.

Hydraulic Profiles. Hydraulic profiles for Thorn Creek and its tributaries are shown in Appendix H. Profiles are shown for the 2-, 5-, 10-, 25-, 50-, 100- and 500-year recurrence interval design storm events.

3.7.3 Development and Evaluation of Alternatives

Hydraulic model results were reviewed with inundation mapping to identify locations where property damage due to flooding is predicted. **Table 3.7.12** summarizes problem areas identified through hydraulic modeling of the Thorn Creek subwatershed.

Problem areas that were hydraulically interdependent or otherwise related were grouped for alternatives analysis. Each problem group is addressed in terms of combined damages and alternatives/solutions.

Table 3.7.12: Modeled Problem Definition for the Thorn Creek Subwatershed

Problem ID	Group ID	Location	Recurrence Interval (yr) of Flooding	Associated Form B	Resolution in DWP
THCR1	THCR-G1	West side of Thorn Creek from Chicago Heights-Glenwood Road to the abandoned B & O Railroad	5, 10, 25, 50 & 100	GLW2	THCRG1-A16
THCR2	THCR-G1	West side of Thorn Creek at Park Side and Union Avenues	5, 10, 25, 50 & 100	None	THCRG1-A16
THCR3	THCR-G1	Thorn Creek at 26th Street	5, 10, 25, 50 & 100	PAR3	THCRG1-A16
TCTB1	THCR-G1	Irving Blvd and Franklin Avenue to IL 1, 1000ft southwest of Halsted Street, Chicago Heights	5, 10, 25, 50 & 100	None	THCRG1-A16
THCR4	THCR-G2	Thorn Creek at Sauk Trail Road	50 & 100	None	THCRG2-A1
TCTA1	TCTA-G1	26th Street & Stewart to State Street & 22nd Street, Chicago Heights	2, 5, 10, 25, 50 & 100	None	TCTAG1-A8
TCTA2	TCTA-G1	Arnold Street from 15th Street to 12th Street (extended), Chicago Heights	2, 5, 10, 25, 50 & 100	None	TCTAG1-A8
TCTA3	TCTA-G1	32nd Street & Phillips Avenue to 33rd Street & Lewis Avenue, Steger	2, 5, 10, 25, 50 & 100	None	TCTAG1-A8
TCTB2	TCTB-G1	Lincoln Highway and Wilson Avenue to Irving Blvd and Franklin Avenue, Chicago Heights	50 & 100	None	TCTBG1-A1
TCTD1	TCTD-G1	Station Drive & Front Street, 216th Street & Oak Street, Charles Street and 218th Street, Park Forest and Matteson	2, 5, 10, 25, 50 & 100	None	TCTDG1-A9
TCTD2	TCTD-G1	E and W Rocket Circle Drive to Lakewood Blvd, Park Forest	2, 5, 10, 25, 50 & 100	PAR1	TCTDG1-A9

Damage assessment, technology screening, alternative development and alternative selection were done by problem grouping, since each group is independent of the other. Each problem group is evaluated in the following sections by Group ID.

3.7.3.1 THCR-G1 – Thorn Creek Problem Group 1

3.7.3.1.1 Problem Definition

The THCR-G1 problem area consists of flooding from four related areas. The first problem area (THCR1) consists of overbank flooding in Glenwood along the west side of Thorn Creek from Chicago Heights-Glenwood Road to the abandoned B & O Railroad. In this reach, 100-year flows ranging between 8,025 cfs at Chicago Heights-Glenwood Road to 7,872 cfs at the abandoned B&O Railroad exceeds the capacity of the channel. The flooding in Glenwood includes 3 structures within Glenwood School for Boys and approximately 45 structures west of Arquilla Park. The Glenwood area is shown on the recent DFIRM floodplain maps with flooding to a lesser extent. The flood protection elevation is approximately at 613 feet NGVD.

The second problem area (THCR2) consists of overbank flooding in Chicago Heights along the west side of Thorn Creek near the intersection of Parkside Avenue and Union Avenue. In this reach, the 100-year flow is approximately 2,890 cfs at Halsted

Street, exceeding the capacity of the channel. The flooding in Chicago Heights includes 8 structures within the adjacent subdivision. The Chicago Heights area is shown on the recent DFIRM floodplain maps with flooding, but to a slightly lesser extent. The flood protection elevation is approximately 635 feet NGVD.

The third problem area (THCR3) consists of overtopping of 26th Street at the outlet of Sauk Lake at the border of Chicago Heights and South Chicago Heights. In this reach, 100 year flows at are approximately 1,830 cfs. Flooding at this location impacts traffic along 26th Street, a major roadway, but does not impact any properties. This area is shown as flooded on the current FEMA DFIRMs. The flood protection elevation is approximately 681 feet, 1 foot below the current top of the road.

The forth problem area (TCTB1) is located on Thorn Creek Tributary B, and consists of overbank flooding in Chicago Heights along the creek from Irving Boulevard and Franklin Avenue to IL Rte. 1, 1,000 feet southwest of Halsted Street, in Chicago Heights. In this reach, 100-year flows range from 463 cfs at the 10th Street culvert to 704 cfs at the intersection of Parkside Avenue and Peoria Street. The flooding in Chicago Heights is shown on the recent DFIRM floodplain maps with flooding to a lesser extent. The flood protection elevation is approximately 655 feet NGVD at the upstream, to 637.42 NGVD at the downstream. Flood protection elevations at all the problem areas were developed based on field reconnaissance of the area based on typical residential structures.

3.7.3.1.2 Damage Assessment, THCR-G1

Damages were defined following the protocol defined in the CCSMP. Critical duration analysis was performed to determine the highest flood stages for Thorn Creek and its tributaries. These stages were used to calculate the depth of flooding and to estimate damages at each flooding problem area. The District's Stormwater Planning Database Tool was used to estimate the damages. Property damages for each building structure were calculated and transportation damages were estimated at 15% of the property damages, unless otherwise noted. Recreation damages were estimated based on depth and duration of flooding. **Table 3.7.13** lists the estimated damages for the problem group.

Table 3.7.13: Estimated Damages for Thorn Creek Subwatershed, Problem Group THCR-G1

Problem Group ID	Damage Category	Estimated Damage ($)	Description
THCR-G1	Property	$1,167,000	Structures at risk of flooding.
	Transportation	$175,000	Assumed as 15% of property damage due to flooding.
	Recreation	$0	

3.7.3.1.3 Technology Screening, THCR-G1

Several combinations of technologies were analyzed to address the flooding problems associated with THCR-G1. Flood control technologies from the CCSMP were considered as potential solutions for the regional flooding problems. **Table 3.7.14**

summarizes the evaluation of these technologies in terms of their potential feasibility for this problem group.

Table 3.7.14: Evaluation of Flood Control Technologies for Thorn Creek Subwatershed, Problem Group THCR-G1

Flood Control Option	Feasibility
Detention Facilities	Feasible and necessary at Sauk Lake/THCR3 for downstream stage reduction. Infeasible in THTB1 due to lack of available space. Infeasible at downstream THCR1 & THCR2 due to extremely large storage requirements
Conveyance Improvement – Culvert/ Bridge Replacement	Feasible and necessary at Sauk Lake/THCR3 to prevent Dam overtopping. Feasible and necessary in TCTB1 to decrease stages
Conveyance Improvement – Channel Improvement	Feasible and necessary in TCTB1, due to space restrictions. Infeasible at downstream THCR1 & THCR2 due to extremely large flows
Conveyance Improvements – Diversion	Feasible and necessary in THTB1 due to limited channel capacity and space restriction. Infeasible at downstream THCR1 & THCR2 due to extremely large flows. Infeasible at Sauk Lake/THCR3 due to unavailable diversion routes
Flood Barriers, Levees/Floodwalls	Feasible and necessary in THCR1 & THCR2 due to limited channel capacity and space restrictions. Infeasible in THTB1 due to lack of available space. Not a suitable solution in THCR3 to prevent dam overtopping

3.7.3.1.4 Alternative Development, THCR-G1

Flood Control Alternatives. Alternative solutions to regional flooding problems were developed and evaluated consistent with the methodology described in **Section 1.4** of this report. **Table 3.7.15** summarizes flood control alternatives developed for Problem Group THCR-G1.

Table 3.7.15: Flood Control Alternatives for Problem Group THCR-G1

Alternative	Location	Description
THCRG1-A1	Sauk Lake	Expand Sauk Lake to decrease downstream flows, control the 100-year flood and to prevent overtopping of 26th Street
THCRG1-A2	Sauk Lake	Provide compensatory storage by modifying the outlet of the Sauk Lake Dam. Simulations of a modified Sauk Lake Dam indicate that downstream stages could be decreased by controlling the 100-year flood (i.e., not allowing 100-year flows to overtop the outlet dam, as occurs under baseline conditions)
THCRG1-A3	Sauk Lake Dam	Adjust the outlet configuration of Sauk Lake Dam to prevent the Dam from overtopping while at the same time decreasing downstream elevations to provide compensatory storage for the Alternative 1 & 2 levees and for the diversion flow from Thorn Creek Tributary A to Thorn Creek

Table 3.7.15: Flood Control Alternatives for Problem Group THCR-G1

Alternative	Location	Description
THCRG1-A4	Forest Preserve	Divert high flows from Thorn Creek to an offline reservoir. This alternative results in an extremely large storage volume requirement due to the large and persistent flows in the main reach. The only feasible area which could provide the required offline storage volume is in Forest Preserve District of Cook County property, and was found to be infeasible
THCRG1-A5	Thornton Composite Reservoir	Adjust operations of the Reservoir. Delaying the opening of the inlet gates to Thornton Composite Reservoir was simulated but did not significantly decrease stages, and resulted in stage increases in the Little Calumet River
THCRG1-A6	Various along Thorn Creek	Increase channel capacity by widening and/or regrading. This was considered infeasible due to the large increase in capacity required to significantly decrease the stages of the existing flows. Increasing channel carrying capacity would also be likely to increase downstream stages and require a large volume of compensatory storage
THCRG1-A7	Various crossings along Thorn Creek	Increase hydraulic openings of bridges and culverts along Thorn Creek. This was considered infeasible due to the large increase in capacity required to significantly decrease the stages of the existing flows. Increasing the hydraulic opening would also be likely to increase downstream stages and require a large volume of compensatory storage
THCRG1-A8	Thorn Creek, Chicago Heights-Glenwood Road to B&O RR tracks	Construct a levee to protect building structures. This alternative results in stage increases of greater than 0.04 ft, so compensatory storage is required
THCRG1-A9	Thorn Creek, Parkside Avenue to Union Avenue	Construct a levee to protect building structures. This alternative results in stage increases of greater than 0.04 ft, so compensatory storage is required
THCRG1-A10	Thorn Creek Tributary B	Construct a levee to protect building structures. This was found infeasible since the levee would have to extend over a long stretch of residential area with numerous road crossings. There is no feasible location to provide compensatory storage
THCRG1-A11	Thorn Creek Tributary B, u/s of Parkside Avenue to confluence	Increase channel capacity by flattening the slope and widening the cross section of Thorn Creek Tributary B from Parkside Avenue to the confluence with Thorn Creek
THCRG1-A12	Thorn Creek Tributary B at Parkside Avenue & IL 1	Increase hydraulic openings of the crossings on Thorn Creek Tributary B at Parkside Avenue and IL Rte. 1
THCRG1-A13	Thorn Creek Tributary B	Add a diversion to Thorn Creek Tributary B with an outlet to Thorn Creek
THCRG1-A14	Length of Thorn Creek Tributary B	Provide a diversion culvert along the length of the creek to discharge further downstream to increase channel conveyance. This option does not sufficiently reduce stages
THCRG1-A15	Thorn Creek Tributary B	Divert flow into THCR. This alternative decreases downstream stages, and compensatory storage is required
THCRG1-A16	Sauk Lake Dam, Thorn Creek, Thorn Creek Tributary B	Adjust the outlet configuration of Sauk Lake Dam, levee construction, increase channel capacity, increase hydraulic openings of crossings, and divert flow into Thorn Creek Reach 7 (combination of Alternatives THCRG1-A3, THCRG1-A8, THCRG1-A9, THCRG1-A11, THCRG1-A12, and THCRG1-A15)

Streambank Stabilization Alternatives. No streambank stabilization alternatives were developed for the THCR-G1 Problem Group.

3.7.3.1.5 Alternative Evaluation and Selection, THCR-G1

Alternatives included in **Table 3.7.15** were evaluated to determine their effectiveness and produce the data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. **Table 3.7.17** provides the B/C ratio, net benefits, total project costs, number of structures protected, and other relevant alternative data for the preferred alternative for Problem Group THCR-G1. Alternatives that did not produce a significant change in inundation areas are not listed as benefits were negligible, thus costs were not calculated for these alternatives.

Alternative THCRG1-A16 from **Table 3.7.15** is the preferred alternative for Problem Group THCR-G1. The preferred alternative includes channel capacity improvements along Thorn Creek Tributary B, levees along Thorn Creek, a diversion structure on Thorn Creek Tributary B and modifying the Sauk Lake Dam to provide compensatory storage. Modifying Sauk Lake Dam by raising the dam spillway elevation to 685.60 feet and adding an additional 5.5-foot by 2.25-foot box culvert to the existing five (5) box culvert configuration results in the 100-year water surface elevation to increase 2.38 feet, which results in 118 acre-feet of additional storage and a decrease in outflow of 582 cfs.

Raising 187th Street in Village of Glenwood to act as a levee at 621.44 feet NGVD (i.e., 3 feet above the 100-year flood stage) should prevent flooding to Glenwood School for Boys. 187th Street would maintain this elevation to south of Butterfield Creek to past Arquilla Park to the north. An additional floodwall at NGVD 621.44 feet would continue north of 187th Street and protect residences west of Arquilla Park from flooding. Chicago Heights Glenwood Road would also be raised 1 foot above the 100 year flood elevation to 619.44 feet NGVD. The bridge opening under Chicago Heights Glenwood Road would likely need to be increased from its current single span formation to allow a similar flow rate to pass through the opening, since it would no longer have overtopping flows. The bike path (former rail road tracks) would also potentially be removed to allow increased conveyance in this area. The recommended alternative also included the following project components:

- Construct a 1,200 linear-foot earthen berm along Thorn Creek next to Parkside Avenue and Union Avenue with a height varying from 1.4 to 6.4 feet.

- Construct a flow diversion from the upstream portion of Thorn Creek Tributary B that follows the existing roads and discharges into Thorn Creek Reach 7.

- Replace the culverts at Thorn Creek Tributary B under Parkside Avenue and IL Rte. 1 with larger box culverts.

- Flatten the slope and widen the cross section of Thorn Creek Tributary B from upstream of Parkside Avenue to the confluence with Thorn Creek.

Table 3.7.16 provides a comparison of the modeled water surface elevation and modeled flow at the time of peak for THCR-G1.

Table 3.7.16: Alternative Condition Flow & WSEL Comparison for Problem Group THCR-G1

Location	Station	Existing Conditions		Alternative THCRG1-A16	
		Max WSEL (ft)	Max Flow (cfs)	Max WSEL (ft)	Max Flow (cfs)
Sauk Lake	SA 211	682.22	689	684.60	630
Halsted Avenue, downstream of Tributary B	Thorn Creek 60185	638.67	2,893	638.00	2,514
Bike Path/Foot Bridge downstream of Halsted Avenue	Thorn Creek 59507	637.00	2,897	636.70[1]	2,524
Downstream of confluence with Thorn Creek Tributary A	Thorn Creek 55515	629.21	3,526	628.81	3,049
Vincennes Avenue	Thorn Creek 37973	617.31	7,975	616.68[1]	7,405
10th St culvert, downstream face	Thorn Cr Tributary B 4839	650.95	463	649.86	492
Parkside Avenue at Peoria Street	Thorn Cr Tributary B 626	641.21	704	638.05	432

[1] Levee provides protection

3.7.3.1.6 Data Required for Countywide Prioritization of Watershed Projects, THCR-G1

Appendix I presents conceptual level cost estimates for the recommended alternative. **Table 3.7.17** lists the alternative analyzed in detail. The recommended alternative consists of channel capacity improvements along Thorn Creek Tributary B, levees along Thorn Creek, a diversion structure on Thorn Creek Tributary B and modifying Sauk Lake Dam to provide compensatory storage. **Figure 3.7.6** shows the location of the recommended alternative and a comparison of the inundation area for existing conditions with the reduced inundation area resulting from the recommended alternative.

Table 3.7.17: Thorn Creek Project Alternative Matrix to Support District CIP Prioritization for Problem Group THCR-G1

Group ID	Alternative ID	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures & Roadways Protected	Water Quality Benefit	Involved Community
THCR-G1	THCRG1-A16	Conveyance Improvement, Levees, Flow Diversion and Storage	0.02	$717,000	$37,660,000	51 Structures, 3 Roadways	No Impact	Chicago Heights, Glenwood, South Chicago Heights

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.7.3.2 THCR-G2 – Thorn Creek Problem Group 2

3.7.3.2.1 Problem Definition, THCR-G2

The THCR-G2 problem area consists of overtopping of Sauk Trail Road within the Forest Preserve District of Cook County property, adjacent to Park Forest. In this reach, 100-year flows are at approximately 1,620 cfs. Flooding at this location impacts traffic along Sauk Trail Road, a major County route, but does not impact any properties. This area is shown as flooded on the current FEMA DFIRMs. The flood protection elevation is approximately 681.74, 1 foot below the current top of the road. Flood protection elevations were developed based on field reconnaissance of the area and the elevation of the existing road.

3.7.3.2.2 Damage Assessment, THCR-G2

Damages were defined following the protocol defined in the CCSMP. Critical duration analysis was performed to determine the highest flood stages for Thorn Creek and its tributaries. These stages were used to calculate the depth of flooding and then to estimate damages at each flooding problem area. The District's Stormwater Planning Database Tool was used to estimate the damages. Property damages for each building structure were calculated and transportation damages were estimated at 15% of the property damages, unless otherwise noted. Recreation damages were estimated based on depth and duration of flooding. **Table 3.7.18** lists the estimated damages for the problem group.

Table 3.7.18: Estimated Damages for Thorn Creek Subwatershed, Problem Group THCR-G2

Problem Group ID	Damage Category	Estimated Damage ($)	Description
THCR-G2	Property	$0	
	Transportation	$1,600,000	Overtopping of Sauk Trail Road
	Recreation	$0	

3.7.3.2.3 Technology Screening, THCR-G2

Several combinations of technologies were analyzed to address the flooding problems at this location. Flood control technologies from the CCSMP were considered as potential solutions for the regional flooding problems. **Table 3.7.19** summarizes the

evaluation of these technologies in terms of their potential feasibility for this problem group.

Table 3.7.19: Evaluation of Flood Control Technologies for Thorn Creek Subbasin, Problem Group THCR-G2

Flood Control Option	Feasibility
Detention Facilities	Unnecessary given alternative
Conveyance Improvement – Culvert/Bridge Replacement	Feasible to adjust Sauk Trail Road grading and bridge opening
Conveyance Improvement – Channel Improvement	Unnecessary given alternative
Conveyance Improvements – Diversion	Unnecessary given alternative
Flood Barriers, Levees/Floodwalls	Unnecessary given alternative

3.7.3.2.4 Alternative Development, THCR-G2

Flood Control Alternatives. An alternative solution to regional flooding problems was developed and evaluated consistent with the methodology described in **Section 1.4** of this report. **Table 3.7.20** summarizes flood control alternative developed for Problem Group THCR-G2.

Table 3.7.20: Flood Control Alternatives for Problem Group THCR-G2

Alternative	Location	Description
THCRG2-A1	Sauk Trail Road	Increase elevation of Sauk Trail Road and adjust bridge opening to prevent overtopping. Increase bridge low chord increase 3.4 ft to elevation 682.7 ft NGVD

Streambank Stabilization Alternatives. No streambank stabilization alternatives were developed for the THCR-G2 Problem Group.

3.7.3.2.5 Alternative Evaluation and Selection, THCR-G2

The alternative included in **Table 3.7.20** was evaluated to determine its effectiveness and produce data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. **Table 3.7.22** provides the B/C ratio, net benefits, total project costs, number of structures protected, and other relevant alternative data for the preferred alternative.

Alternative THCRG2-A1 from **Table 3.7.20** is the preferred alternative for this problem group. The top of road elevation is to be raised to NGVD 686.67 feet to prevent overtopping during the 100-year event. The bridge opening is to be increased by raising the low chord 3.4 feet to elevation 682.7 feet NGVD.

Table 3.7.21 provides a comparison of the modeled water surface elevation and modeled flow at the time of peak for THCR-G2.

Table 3.7.21: Alternative Condition Flow & WSEL Comparison for Problem Group THCR-G2

Location	Station	Existing Conditions		Alternative THCRG2-A1	
		Max WSEL (ft)	Max Flow (cfs)	Max WSEL (ft)	Max Flow (cfs)
Sauk Lake Road, upstream face	Thorn Cr 80864	686.87	1,621	685.67	1,753

3.7.3.2.6 Data Required for Countywide Prioritization of Watershed Projects, THCR-G2

Appendix I presents conceptual level cost estimates for the recommended alternative. **Table 3.7.22** lists the alternative analyzed in detail. The recommended alternative consists of the retrofitting the existing Sauk Trail Road crossing at Thorn Creek by raising the roadway profile and increasing the low chord elevation of the bridge structure. **Figure 3.7.7** shows the location of the recommended alternative and a comparison of the inundation area for existing conditions with the reduced inundation area resulting from the recommended alternative.

Table 3.7.22: Thorn Creek Project Alternative Matrix to Support District CIP Prioritization for Problem Group THCR-G2

Group ID	Alternative ID	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures & Roadways Protected	Water Quality Benefit	Involved Community
THCR-G2	THCRG2-A1	Modify and retrofit bridge	0.63	$1,600,000	$2,543,000	1 Roadway	No Impact	Cook County FPD

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.7.3.3 TCTA-G1 – Thorn Creek Tributary A Problem Group 1

3.7.3.3.1 Problem Definition, TCTA-G1

The TCTA-G1 problem group consists of a combination of three problem areas. The first problem area (TCTA1) consists of overland flooding in Chicago Heights due to insufficient capacity in the existing 6 inch diameter enclosed conduit underneath a residential subdivision from 26th Street and Stewart Avenue to the proximity of the State Street and 22nd Street intersection. In this reach, 100-year flows range from 508 cfs near 26th Street to 275 cfs near the State Street and 22nd Street intersection, and exceed the capacity of the existing culvert. The flooding in Chicago Heights includes approximately 50 homes in the subdivision. This Chicago Heights subdivision is not shown in the recent DFIRM floodplain maps because it was not modeled. The flood protection elevation is approximately 678.91 feet NGVD at 26th Street and 671.79 feet NGVD near 22nd Street.

The second problem area (TCTA2) consists of flooding caused by overflow from the enclosed culvert located from 26th Street and Stewart Avenue to near the State Street and 22nd Street intersection in Chicago Heights. Flooding in this area runs overland, parallel to Stewart Avenue, and eventually returns to Thorn Creek Tributary A at State Street. In this reach, 100-year overflow occurs over approximately 24 hours with a peak flow of 290 cfs, inundating the area with approximately 1 foot of water. The flooding in Chicago Heights includes 10 structures along the overland flow path. This

area is not shown in the recent DFIRM floodplain maps because it was not modeled. The flood protection elevation varies between 657.66 feet NGVD to 635 feet NGVD near State Street.

The third problem area (TCTA3) consists of flooding caused by high stages from Thorn Creek Tributary B, which back up into the upstream residential area in the Village of Steger from 32nd Street and Phillips Avenue to 33rd Street and Lewis Avenue. In this reach, the 100-year peak flow of 552 cfs occurs with a peak elevation of 699.15 feet NGVD, inundating the area with 1 to 3 feet of water. The flood protection elevation is approximately 698 feet, 1 foot below the high point over which flooding occurs. For all problem areas, flood protection elevations were developed based on field reconnaissance of the area and the elevation of the existing roadways.

3.7.3.3.2 Damage Assessment, TCTA-G1

Damages were defined following the protocol defined in the CCSMP. Critical duration analysis was performed to determine the highest flood stages for Thorn Creek and its tributaries. These stages were used to calculate the depth of flooding and then to estimate damages at each flooding problem area. The District's Stormwater Planning Database Tool was used to estimate the damages. Property damages for each building structure were calculated and transportation damages were estimated at 15% of the property damages, unless otherwise noted. Recreation damages were estimated based on depth and duration of flooding. **Table 3.7.23** lists the estimated damages for the problem group.

Table 3.7.23: Estimated Damages for Thorn Creek Subwatershed, Problem Group TCTA-G1

Problem Group ID	Damage Category	Estimated Damage ($)	Description
TCTA-G1	Property	$1,230,000	Structures at risk of flooding.
	Transportation	$184,000	Assumed as 15% of property damage due to flooding
	Recreation	$0	

3.7.3.3.3 Technology Screening, TCTA-G1

Several combinations of technologies were analyzed to address the flooding problems at this location. Flood control technologies from the CCSMP were considered as potential solutions for the regional flooding problems. **Table 3.7.24** summarizes the evaluation of these technologies in terms of their potential feasibility for this problem group.

Table 3.7.24: Evaluation of Flood Control Technologies for Thorn Creek Subwatershed, Problem Group TCTA-G1

Flood Control Option	Feasibility
Detention Facilities	Feasible and necessary to account for stage increases
Conveyance Improvement – Culvert/Bridge Replacement	Feasible and necessary to upgrade existing long enclosed culvert between 26th St and 22nd Street
Conveyance Improvement – Channel Improvement	Feasible but not necessary
Conveyance Improvements – Diversion	Feasible but with potential drawbacks
Flood Barriers, Levees/Floodwalls	Unnecessary given alternative

3.7.3.3.4 Alternative Development, TCTA-G1

Flood Control Alternatives. Alternative solutions to regional flooding problems were developed and evaluated consistent with the methodology described in **Section 1.4** of this report. **Table 3.7.25** summarizes flood control alternatives developed for Problem Group TCTA-G1.

Table 3.7.25: Flood Control Alternatives for Problem Group TCTA-G1

Alternative	Location	Description
TCTAG1-A1	26th Street & Stewart Avenue to State Street & 22nd Street	Upsize existing 6-ft diameter culvert
TCTAG1-A2	Thorn Creek Tributary B, upstream reach	Conveyance improvements by removing two minor culverts under restrictive footpaths and replacing with non-obstructive footbridges
TCTAG1-A3	Upstream of 26th Street	Construct 540 ac-ft of offline storage facility upstream of the enclosed culvert to reduce the current peak flow of 508 cfs to 120 cfs, the approximate capacity of the current 6-ft diameter culvert. Based on meetings with local officials, there is not a site available that could provide this storage volume
TCTAG1-A4	Upstream of 26th Street & downstream of 22nd Street	Construct 180 ac-ft offline storage facility upstream of culvert and 660 ac-ft storage facility downstream of culvert to reduce flow volumes
TCTAG1-A5	Various along Thorn Creek Tributary A	Increasing channel conveyance along Thorn Creek Tributary A. Re-grading and/or widening the creek does not have a benefit unless the undersized culvert is also addressed
TCTAG1-A6	Various along Thorn Creek Tributary A	Construct a levee along Thorn Creek Tributary A. Using a levee would not be feasible due to the residential nature of the streets and area surrounding the long enclosed culvert

Table 3.7.25: Flood Control Alternatives for Problem Group TCTA-G1

Alternative	Location	Description
TCTAG1-A7	26th Street	Divert peak flows from Thorn Creek Tributary A to Sauk Lake by constructing a 7,700 LF box culvert underneath 26th Street. This would require adjustments to the dam outlet structure at Sauk Lake. While potentially effective, this alternative was not pursued because the cost of the culvert would be prohibitive
TCTAG1-A8	26th Street & Stewart Avenue to State Street & 22nd Street, Thorn Creek Tributary B upstream reach, Upstream of 26th Street & downstream of 22nd Street	Upsize culvert, conveyance improvements, and offline storage facility (combination of Alternatives TCTAG1-A1, TCTAG1-A2 and TCTAG1-A4)

Streambank Stabilization Alternatives. No streambank stabilization alternatives were developed for the TCTA-G1 Problem Group.

3.7.3.3.5 Alternative Evaluation and Selection, TCTA-G1

Alternatives included in **Table 3.7.25** were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. **Table 3.7.27** provides the B/C ratio, net benefits, total project costs, number of structures protected, and other relevant alternative data for the preferred alternative. Alternatives that did not produce a significant change in inundation areas are not listed as benefits were negligible, thus costs were not calculated for these alternatives.

Alternative TCTAG1-A8 from **Table 3.7.25** provides the preferred alternative for this problem group. To relieve flooding in this problem area two objectives must be met: 1) prevent overtopping of the enclosed culvert from 26th Street and Stewart Avenue to State Street and 22nd Street; and 2) decrease the stage at the upstream reach of Thorn Creek Tributary B to prevent flows from backing up into the upstream residential area.

The preferred alternative has several recommended components, listed below.

- Replace the 6-foot diameter enclosed culvert between 26th Street and Stewart Avenue to 22nd Street near State Street with two (2) 9-foot by 6-foot box culverts.

- Construct offline detention upstream and downstream of this culvert. The upstream detention area would hold approximately 180 acre-feet of storage. The downstream detention area would contain approximately 660 acre-feet. Both storage facilities would require pumping to drain the facilities after a storm. Neither facility is directly adjacent to the stream and would therefore require inlet pipes of significant lengths, 1,300 feet and 1,700 feet for the upstream and downstream detention facilities respectively. This would allow

all flow to be contained within the proposed double box culvert. The inlet water surface elevation should be no higher than approximately 676 feet NGVD to prevent surcharging of the long enclosed box culvert.

- Remove two culverts in the upstream reach of Thorn Creek Tributary B. The first culvert appears to be within a power company right-of-way and consists of a small circular culvert and a large box culvert. It is located 550 feet north and 450 feet east of the intersection of 30th Street and Holeman Avenue in Chicago Heights. The second culvert is a 5-foot by 2-foot elliptical culvert approximately 180 feet west of the intersection of Loverock Avenue and 32nd Street that appears to serve as a crossing for pedestrians. Both culverts would be removed and replaced by non-obstructive foot bridges.

Table 3.7.26 provides a comparison of the modeled water surface elevation and modeled flow at the time of peak for TCTA-G1.

Table 3.7.26: Alternative Condition Flow & WSEL Comparison for Problem Group TCTA-G1

		Existing Conditions		Alternative TCTAG1-A8	
Location	**Station**	**Max WSEL (ft)**	**Max Flow (cfs)**	**Max WSEL (ft)**	**Max Flow (cfs)**
State Street	Thorn Creek Tributary A 15378	665.30	275	663.93	184
RR 800 ft upstream of 26th Street	Thorn Creek Tributary A 20296	687.80	508	678.33	413
DS Face Loverock Avenue	Thorn Creek Tributary A 27528	699.15	553	697.40	553

3.7.3.3.6 Data Required for Countywide Prioritization of Watershed Projects, TCTA-G1

Appendix I presents conceptual level cost estimates for the recommended alternative. **Table 3.7.27** lists the alternative analyzed in detail. The recommended alternative consists of upgrading the diameter of the culvert conveying the creek, providing upstream and downstream compensatory storage, and removing restrictive culvert crossings. **Figure 3.7.8** shows the location of the recommended alternative and a comparison of the inundation area for existing conditions with the reduced inundation area resulting from the recommended alternative.

Table 3.7.27: Thorn Creek Project Alternative Matrix to Support District CIP Prioritization for Problem Group TCTA-G1

Group ID	Alternative ID	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures & Roadways Protected	Water Quality Benefit	Involved Community
TCTA-G1	TCTAG1-A8	Upgrade crossings, offline detention, upsize culvert	0.02	$1,415,000	$89,000,000	51 Structures	Positive	Chicago Heights, South Chicago Heights, Steger

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.7.3.4 TCTB-G1 – Thorn Creek Tributary B Problem Group 1

3.7.3.4.1 Problem Definition, TCTB-G1

The TCTB-G1 problem area consists of overbank flooding in Chicago Heights from Lincoln Highway and Wilson Avenue to Irving Boulevard and Franklin Avenue. In this reach, the 100-year flow ranges from approximately 193 cfs at Lincoln Highway to 238 cfs at Irving Boulevard. The potential flooding in Chicago Heights includes about 40 structures within a residential subdivision. The problem area is shown on the recent DFIRM floodplain maps with flooding to a similar extent. The flood protection elevation is approximately at 664 feet NGVD at the upstream, and 659.2 feet in the downstream. Flood protection elevations were developed based on field reconnaissance of the area based on typical residential structures.

3.7.3.4.2 Damage Assessment, TCTB-G1

Damages were defined following the protocol defined in the CCSMP. Critical duration analysis was performed to determine the highest flood stages for Thorn Creek and its tributaries. These stages were used to calculate the depth of flooding and then to estimate damages at each flooding problem area. The District's Stormwater Planning Database Tool was used to estimate the damages. Property damages for each building structure were calculated and transportation damages were estimated at 15% of the property damages, unless otherwise noted. Recreation damages were estimated based on depth and duration of flooding. **Table 3.7.28** lists the estimated damages for the problem group.

Table 3.7.28: Estimated Damages for Thorn Creek Subwatershed, Problem Group TCTB-G1

Problem Group ID	Damage Category	Estimated Damage ($)	Description
TCTB-G1	Property	$6,800	Structures at risk of flooding
	Transportation	$1,200	Assumed as 15% of property damage due to flooding
	Recreation	$0	

3.7.3.4.3 Technology Screening, TCTB-G1

Several combinations of technologies were analyzed to address the flooding problems at this location. Flood control technologies from the CCSMP were considered as potential solutions for the regional flooding problems. **Table 3.7.29** summarizes the evaluation of these technologies in terms of their potential feasibility for this problem group.

Table 3.7.29: Evaluation of Flood Control Technologies for Thorn Creek Subwatershed, Problem Group TCTB-G1

Flood Control Option	Feasibility
Detention Facilities	Not feasible due to limited space
Conveyance Improvement – Culvert/Bridge Replacement	Feasible but limited
Conveyance Improvement – Channel Improvement	Feasible and necessary
Conveyance Improvements – Diversion	Feasible but undesirable
Flood Barriers, Levees/Floodwalls	Not feasible due to space restrictions

3.7.3.4.4 Alternative Development, TCTB-G1

Flood Control Alternatives. Alternative solutions to regional flooding problems were developed and evaluated consistent with the methodology described in **Section 1.4** of this report. **Table 3.7.30** summarizes flood control alternatives developed for Problem Group TCTB-G1.

Table 3.7.30: Flood Control Alternatives for Problem Group TCTB-G1

Alternative	Location	Description
TCTBG1-A1	Various along Thorn Creek Tributary B	Replace restricting culverts. This is a feasible option, although most culverts do not have much potential for significant expansion
TCTBG1-A2	Thorn Creek Tributary B	Divert flow to the downstream reach. Additional flow to this reach was undesirable since it already experiences flooding.
TCTBG1-A3	Various along Thorn Creek Tributary B	Decreasing stages by increasing culvert flow capacities was deemed feasible though most culverts did not have much potential for significant expansion
TCTBG1-A4	Various along Thorn Creek Tributary B	Conveyance improvements by widening the channel and decreasing the channel roughness. This alternative has the potential to produce reasonable stage decreases. This could be achieved by creating a wider, concrete-lined trapezoidal channel, although other design alternatives may be possible

Streambank Stabilization Alternatives. No streambank stabilization alternatives were developed for the TCTB-G1 Problem Group.

3.7.3.4.5 Alternative Evaluation and Selection, TCTB-G1

Alternatives included in **Table 3.7.30** were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. **Table 3.7.32** provides the B/C ratio, net benefits, total project costs, number of structures protected, and other relevant alternative data for the

preferred alternative. Alternatives that did not produce a significant change in inundation areas are not listed, as benefits were negligible, and thus costs were not calculated for these alternatives.

Alternative TCTBG1-A1 from **Table 3.7.30** is the preferred alternative for this problem group. In this problem area, flooding occurs from a lack of channel capacity in a heavily residential area, and a lack of space is the limiting factor. The preferred alternative involves widening the existing channel along Thorn Creek Tributary B and decreasing its roughness. The new channel would have a trapezoidal cross section with a wider bottom width. The overall channel slope would remain the same. The roughness could potentially be reduced by using a concrete lining, although alternate designs could be conceived in the detailed design phase. Overall, this design decreases stages by 0.2 to 1.7 feet throughout this reach.

Table 3.7.31 provides a comparison of the modeled water surface elevation and modeled flow at the time of peak for TCTB-G1.

Table 3.7.31: Alternative Condition Flow & WSEL Comparison for Problem Group TCTB-G1

Location	Station	Existing Conditions		Alternative TCTBG1-A1	
		Max WSEL (ft)	Max Flow (cfs)	Max WSEL (ft)	Max Flow (cfs)
Wilson Ave US Face	Thorn Creek Tributary B 8865	664.11	193	662.48	193
Irving Blvd and Franklin Ave	Thorn Creek Tributary B 5822	654.21	236	652.62	238

[1] Levee provides protection

3.7.3.4.6 Data Required for Countywide Prioritization of Watershed Projects, CTB-G1

Appendix I presents conceptual level cost estimates for the recommended alternative. **Table 3.7.32** lists the alternative analyzed in detail. The recommended alternative consists of widening the existing channel and decreasing the channel roughness. **Figure 3.7.9** shows the location of the recommended alternative and a comparison of the inundation area for existing conditions with the reduced inundation area resulting from the recommended alternative.

Table 3.7.32: Thorn Creek Project Alternative Matrix to Support District CIP Prioritization for Problem Group TCTB-G1

Group ID	Alternative ID	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures & Roadways Protected	Water Quality Benefit	Involved Community
TCTB-G1	TCTBG1-A1	Channel conveyance improvements	< 0.01	$8,000	$6,900,000	4 Structures, 3 Roadways	No Impact	Chicago Heights

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.7.3.5 TCTD-G1 – Thorn Creek Tributary D Problem Group 1

3.7.3.5.1 Problem Definition, TCTD-G1

The TCTD-G1 problem group consists of two problem areas. The first problem area (TCTD1) consists of overbank flooding in Park Forest and Matteson upstream of Thorn Creek Tributary D along Station Drive and Front Street, 216th Street and Oak Street, and Charles Street and 218th Street (Storage Area 212). In this reach, the 100-year peak flow is 507 cfs. No profile is available for the storage area; the elevation in the storage area is 704.60 feet NGVD. The potential flooding in Park Forest and Matteson includes about 78 structures within the adjacent residential and industrial areas. Flooding in Park Forest and Matteson is shown on the recent DFIRM floodplain maps only in Central Park. The large public park at the downstream end of the reach is marked as Zone X, indicating the drainage area for the reach should be less than 1 square mile. The revised hydrology indicates that the drainage area at this location is greater than 1 square mile. The flood protection elevation is approximately 700.3 feet NGVD for the entire area.

The second problem area (TCTD2) consists of ponding in Park Forest in the reach adjacent to East and West Rocket Circle Drive to Lakewood Boulevard. In this reach, the 100-year peak flow is approximately 236 cfs at the pedestrian walkway near West Rocket Circle Drive and 277 cfs at the upstream face of Lakewood Boulevard. The potential flooding in Park Forest includes approximately 28 residences within the adjacent subdivision. The Park Forest area is shown on the recent DFIRM floodplain maps marked as Zone X, likely meaning this area has less than 1 square mile of drainage area. Revised hydrology indicates a drainage area of greater than 1 square mile. The flood protection elevation is approximately 703.7 feet NGVD. Flood protection elevations for both problem areas were developed based on field reconnaissance of the area based on typical residential structures.

3.7.3.5.2 Damage Assessment, TCTD-G1

Damages were defined following the protocol defined in the CCSMP. Critical duration analysis was performed to determine the highest flood stages for Thorn Creek and its tributaries. These stages were used to calculate the depth of flooding and then to estimate damages at each flooding problem area. The District's Stormwater Planning Database Tool was used to estimate the damages. Property damages for each building structure were calculated and transportation damages were estimated at 15% of the property damages, unless otherwise noted. Recreation

damages were estimated based on depth and duration of flooding. **Table 3.7.33** lists the damages caused from the problem group.

Table 3.7.33: Estimated Damages for Thorn Creek Subwatershed, Problem Group TCTD-G1

Problem Group ID	Damage Category	Estimated Damage ($)	Description
TCTD-G1	Property	$4,900,000	Structures at risk of flooding
	Transportation	$740,000	Assumed as 15% of property damage due to flooding
	Recreation	$0	

3.7.3.5.3 Technology Screening, TCTD-G1

Several combinations of technologies were analyzed to address the flooding problems at this location. Flood control technologies from the CCSMP were considered as potential solutions for the regional flooding problems. **Table 3.7.34** summarizes the evaluation of these technologies in terms of their potential feasibility for this problem group.

Table 3.7.34: Evaluation of Flood Control Technologies for Thorn Creek Subwatershed, Problem Group TCTD-G1

Flood Control Option	Feasibility
Detention Facilities	Feasible
Conveyance Improvement – Culvert/Bridge Replacement	Feasible
Conveyance Improvement – Channel Improvement	Feasible but not necessary
Conveyance Improvements – Diversion	Not feasible
Flood Barriers, Levees/Floodwalls	Not feasible due to space restrictions

3.7.3.5.4 Alternative Development, TCTD-G1

Flood Control Alternatives. Alternative solutions to regional flooding problems were developed and evaluated consistent with the methodology described in **Section 1.4** of this report. **Table 3.7.35** summarizes flood control alternatives developed for Problem Group TCTD-G1.

Table 3.7.35: Flood Control Alternatives for Problem Group TCTD-G1

Alternative	Location	Description
TCTDG1-A1	Thorn Creek Tributary D	Divert flow to downstream reach. Any flow diversion results in increased downstream stages. There is no possibility for downstream offline storage due to space restrictions
TCTDG1-A2	Culvert from Krotiak Road to Westwood Drive	Restore culvert conveying Thorn Creek Tributary D to its original, open channel condition. This increases downstream stages, requiring offline storage, which is not available
TCTDG1-A3	Thorn Creek Tributary D	Divert flow to Sauk Lake along the power line right-of-way. This option would significantly increase outflows from Sauk Lake and cause downstream stage increases in Thorn Creek

Table 3.7.35: Flood Control Alternatives for Problem Group TCTD-G1

Alternative	Location	Description
TCTDG1-A4	Central Park, Park Forest	Create a 530 ac-ft offline storage area in the upstream reach of Thorn Creek Tributary D. Central Park in Park Forest has a large enough footprint to construct the detention facility
TCTDG1-A5	Lakewood Blvd. between East Rocket Circle and Orchard Drive	Construct levees to alleviate flooding to businesses and backyards of residences. Offline storage in the area would be required to compensate for increases in downstream stages
TCTDG1-A6	Lakewood Boulevard	Divert flow to downstream reach. This would result in increases in downstream stages, with no possibility for downstream offline storage due to space restrictions
TCTDG1-A7	Lakewood Boulevard Culvert	Upgrade existing double, 3.5-ft diameter culvert to a single, 10-ft by 5-ft box culvert
TCTDG1-A8	East of Gold Street and East Rocket Circle	Remove an existing 5-ft diameter corrugated metal pipe sidewalk crossing and replace with an unobtrusive foot bridge
TCTDG1-A9	Central Park, Lakewood Boulevard culvert, east of Gold Street and East Rocket Circle	530 ac-ft offline storage facility, upgrade culvert crossings (combination of Alternatives TCTDG1-A4, TCTDG1-A7 and TCTDG1-A8)

Streambank Stabilization Alternatives. No streambank stabilization alternatives were developed for the TCTD-G1 Problem Group.

3.7.3.5.5 Alternative Evaluation and Selection, TCTD-G1

Alternatives included in **Table 3.7.35** were evaluated to determine their effectiveness and produce data required for the countywide prioritization of watershed projects. Flood control alternatives were modeled to evaluate their impact on water elevations and flood damages. **Table 3.7.37** provides the B/C ratio, net benefits, total project costs, number of structures protected, and other relevant alternative data for the preferred alternative. Alternatives that did not produce a significant change in inundation areas are not listed as benefits were negligible, thus costs were not calculated for these alternatives.

Alternative TCTDG1-A9 from **Table 3.7.35** provides the preferred alternative for this problem group. This alternative consists of an offline storage basin and upgrading or replacing two crossings. The offline storage could be located within Park Forest's Central Park. A storage basin could hold approximately 530 acre-feet and be 11 feet deep, with a footprint of approximately 56 acres. A pumped outlet would be required. The potential exists to retrofit the park to maintain some of its existing recreational uses. This storage area will reduce peak stages to 702.5 feet NGVD, below the existing stages of 706 feet NGVD, although not achieving the optimal no-damage elevation of 700.3 feet NGVD.

The preferred alternative also includes conveyance improvements within the upstream portion of Thorn Creek Tributary D. The culvert underneath Lakewood Boulevard could be upgraded from double, 3.5-ft diameter culverts to a single, 10-foot by 5-foot box culvert. A restrictive sidewalk crossing located 200 feet east of Gold

Street and East Rocket Circle could be removed and replaced by a non-obstructive foot bridge. This would decrease stages in this reach by 1.8 feet, to below the flood protection stage of 705.8 feet NGVD.

Table 3.7.36 provides a comparison of the modeled WSEL and modeled flow at the time of peak for TCTD-G1.

Table 3.7.36: Alternative Condition Flow & WSEL Comparison for Problem Group TCTD-G1

Location	Station	Existing Conditions		Alternative TCTDG1-A9	
		Max WSEL (ft)	Max Flow (cfs)	Max WSEL (ft)	Max Flow (cfs)
Area US of Central Park	SA 212	704.60	507	702.37	141
Upstream face of Lakewood Blvd	Thorn Cr Tributary D 5822	706.74	236	704.96	238

3.7.3.5.6 Data Required for Countywide Prioritization of Watershed Projects, TCTD-G1

Appendix I presents conceptual level cost estimates for the recommended alternative. **Table 3.7.37** lists the alternative analyzed in detail. The recommended alternative consists of providing 530 acre-feet of offline storage and upgrading or replacing two crossings. **Figure 3.7.10** shows the location of the recommended alternative and a comparison of the inundation area for existing conditions with the reduced inundation area resulting from the recommended alternative.

Table 3.7.37: Thorn Creek Project Alternative Matrix to Support District CIP Prioritization for Problem Group TCTD-G1

Group ID	Alternative ID	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures & Roadways Protected	Water Quality Benefit	Involved Community
TCTD-G1	TCTDG1-A9	Central Park offline storage, upstream conveyance Improvements	0.08	$5,500,000	$65,442,000	22 structures, 1 roadway	Positive	Park Forest

Note: Net Benefits values do not include local benefits or non-economic benefits.

3.7.4 Recommended Alternatives, Thorn Creek Subwatershed

Table 3.7.38 summarizes the recommended alternatives for the Thorn Creek subwatershed. The District will use data presented here to support prioritization of a countywide stormwater CIP.

Table 3.7.38: Thorn Creek Project Alternative Matrix to Support District CIP Prioritization, All Problem Groups

Group ID	Alternative ID	Description	B/C Ratio	Net Benefits ($)	Total Project Cost ($)	Cumulative Structures & Roadways Protected	Water Quality Benefit	Involved Community
THCR-G1	THCRG1-A16	Conveyance improvement, levees, flow diversion and storage	0.02	$717,000	$37,660,000	51 Structures, 3 Roadways	No impact	Chicago Heights, Glenwood, South Chicago Heights
THCR-G2	THCRG2-A1	Modify and retrofit bridge	0.63	$1,600,000	$2,543,000	1 Roadway	No impact	Cook County FPD
TCTA-G1	TCTAG1-A8	Upgrade crossings, offline detention, upsize culvert	0.02	$1,415,000	$89,000,000	51 Structures	Positive	Chicago Heights, South Chicago Heights, Steger
TCTB-G1	TCTBG1-A1	Channel conveyance improvements	<0.01	$8,000	$6,900,000	4 Structures, 3 Roadways	No impact	Chicago Heights
TCTD-G1	TCTDG1-A9	Central Park offline storage, upstream conveyance Improvements	0.08	$5,500,000	$65,442,000	22 Structures, 1 Roadway	Positive	Park Forest

Note: Net Benefits values do not include local benefits or non-economic benefits.